

CLAIMS

What is claimed is:

- 1 1. A switching node apparatus for use in an optical burst-switched network, comprising:
2 optical switch fabric, having at least one input fiber port and at least one output fiber
3 port; and
4 a control unit, operatively coupled to control the optical switch fabric, including at
5 least one processor and a storage device operatively coupled to said at least one processor
6 containing machine-executable instructions, which when executed by said at least one
7 processor perform operations, including:
8 receiving a resource reservation request to reserve a bandwidth resource
9 provided by the switching node apparatus, said resource reservation relating to a
10 portion of a lightpath comprising a plurality of lightpath segments coupled between
11 network nodes, including incoming and outgoing lightpath segments coupled to an
12 input and an output port of the switching node apparatus, respectively;
13 reserving the bandwidth resource;
14 detecting an unavailability of the bandwidth resource;
15 generating a resource cancellation message; and
16 sending the resource cancellation message to at least one network node along
17 the lightpath.

1 2. The apparatus of claim 1 wherein execution of the instructions further performs the
2 operations of:

3 canceling a resource reservation in response to receiving a resource cancellation
4 message.

1 3. The apparatus of claim1, where the optical burst-switched network is a mesh-
2 architecture optical network.

1 4. The apparatus of claim 1, further comprising at least one input port to link in
2 communication with one or more edge nodes of the optical burst-switched network.

1 5. The apparatus of claim 1, wherein the optical burst-switched network comprises a
2 photonic burst switched (PBS) network.

1 6. The apparatus of claim 5, wherein the optical burst-switched network comprises a
2 wavelength-division multiplexed (WDM) PBS network; and the optical switching fabric
3 provides switching of optical signals comprising different wavelengths carried over common
4 fibers that may be respectively coupled to said at least one input fiber port and said at least
5 one output fiber port.

1 7. The apparatus of claim 5, wherein the resource reservation request is sent via a PBS
2 control burst, and the resource cancellation message is included as part of a resource
3 cancellation control burst having a format similar to the PBS control burst.

1 8. The apparatus of claim 1, wherein reserving the bandwidth resource comprises
2 storing resource reservation data in a resource reservation table.

1 9. The apparatus of claim 1, wherein detecting an unavailability of the reserved resource
2 comprises detecting a traffic contention that limits access to the reserved resource.

1 10. The apparatus of claim 1, wherein detecting an unavailability of the reserved resource
2 comprises detecting one of a failure of the switching node apparatus or failure of one of the
3 incoming and outgoing fiber links.

1 11. The apparatus of claim 1, wherein the resource cancellation message is sent to a
2 network node that is downstream from the switching node apparatus.

1 12. The apparatus of claim 1, wherein the resource cancellation message is sent to a
2 network node that is upstream from the switching node apparatus.

1 13. A method, comprising:
2 reserving, via corresponding resource reservations, network resources at
3 respective network nodes of an optical-switched network, said network nodes are
4 coupled via lightpath segments comprising a lightpath for which the network
5 resources are reserved;
6 detecting an unavailability of a network resource along the lightpath;

7 generating a resource cancellation message identifying network resources that
8 may be released;
9 sending the resource cancellation message to at least one network node along
10 the lightpath; and
11 canceling any resource reservations identified by the resource cancellation
12 message for said at least one network node.

1 14. The method of claim 13, where the optical-switched network is a mesh-architecture
2 optical network.

1 15. The method of claim 13, where one or more edge nodes are directly connected to at
2 least one switching node of the optical-switched network.

1 16. The method of claim 13, wherein the optical-switched network comprises a photonic
2 burst-switched (PBS) network.

1 17. The method of claim 16, wherein the optical-switched network comprises a
2 wavelength-division multiplexed (WDM) PBS network.

1 18. The method of claim 16, wherein the resource reservation request is sent via a PBS
2 control burst, and the resource cancellation message is included as part of a resource
3 cancellation control burst having a format similar to the PBS control burst.

1 19. The method of claim 16, wherein each node is responsible for managing its own
2 resource cancellation messages and releasing its resources.

1 20. The method of claim 16, wherein the unavailability of the network resource is
2 detected at a given network node, and the resource cancellation message is sent to all
3 network nodes that are upstream along the lightpath from said given network node.

1 21. The method of claim 16, wherein the unavailability of the network resource is
2 detected at a given network node, and the resource cancellation message is sent to all
3 network nodes that are downstream along the lightpath from said given network node.

1 22. The method of claim 16, wherein the unavailability of the network resource is
2 detected at a given network node, and the resource cancellation message is sent to all other
3 network nodes that are along the lightpath.

1 23. The method of claim 16, wherein the resource cancellation message is generated at a
2 given network node for which wherein the unavailability of the network resource is detected.

1 24. The method of claim 16, wherein reserving the network resource comprises storing
2 resource reservation data in a resource reservation table, and wherein canceling the resource
3 reservation comprises one of deleting or invalidating a record in the resource reservation
4 table corresponding to the resource reservation.

1 25. The method of claim 16, wherein detecting an unavailability of the reserved network
2 resource comprises detecting a traffic contention that limits access to the reserved resource.

1 26. The method of claim 16, wherein detecting an unavailability of the reserved network
2 resource comprises detecting one of a failure of the switching node apparatus or failure of
3 one of the incoming and outgoing fiber links.

1 27. The method of claim 16, wherein the resource cancellation message contains data
2 identifying a type of resource unavailability that is detected.

1 28. The method of claim 16, wherein the resource cancellation message contains data
2 identifying the node at which the resource unavailability was detected.

1 29. The method of claim 16, wherein the resource cancellation message contains data
2 identifying at least one label corresponding to one or more resource reservations that are to
3 be cancelled.

1 30. The method of claim 16, wherein the resource cancellation message contains data
2 identifying a lightpath for which resource reservations are to be cancelled.

1 31. The method of claim 30, wherein the data identifying the lightpath for which resource
2 reservations are to be cancelled comprises a burst identifier (ID) that matches a control burst
3 ID corresponding to a control burst that was employed to make the resource reservations.

1 32. A machine-readable medium to provide instructions, which when executed by a
2 processor in a switching node apparatus comprising a network node in an optical switched
3 network, cause the switching node apparatus to perform operations comprising:

4 receiving a resource reservation request to reserve a bandwidth resource
5 provided by the switching node apparatus, said resource reservation relating to a
6 portion of a lightpath comprising a plurality of lightpath segments coupled between
7 network nodes in the optical switched network, including incoming and outgoing
8 lightpath segments coupled to the switching node apparatus;

9 reserving the network resource;

10 detecting an unavailability of the network resource;

11 generating a resource cancellation message; and

12 sending the resource cancellation message to at least one network node along
13 the lightpath.

1 33. The machine-readable medium of claim 32 wherein execution of the instructions
2 further performs the operations of:

3 canceling a resource reservation in response to receiving a resource cancellation
4 message.

1 34. The machine-readable medium of claim 32, wherein the optical burst-switched
2 network comprises a photonic burst switched (PBS) network.

1 35. The machine-readable medium of claim 34, wherein the optical burst switching
 2 network comprises a wavelength-division multiplexed (WDM) PBS network; and the optical
 3 switching fabric provides switching of optical signals comprising different wavelengths
 4 carried over common fibers that may be respectively coupled to said at least one input fiber
 5 port and said at least one output fiber port.

1 36. The machine-readable medium of claim 34, wherein the resource reservation request
 2 is sent via a PBS control burst, and the resource cancellation message is included as part of a
 3 resource cancellation control burst having a format similar to the PBS control burst.

1 37. The machine-readable medium of claim 32, wherein reserving the bandwidth
 2 resource comprises storing resource reservation data in a resource reservation table.

1 38. The machine-readable medium of claim 32, wherein detecting an unavailability of the
 2 reserved resource comprises detecting a traffic constraint that limits access to the reserved
 3 resource.

1 39. The machine-readable medium of claim 32, wherein detecting an unavailability of the
 2 reserved resource comprises detecting one of a failure of the switching node apparatus or
 3 failure of one of the incoming and outgoing fiber links.

1 40. The machine-readable medium of claim 32, wherein the resource cancellation
 2 message is sent to a network node that is downstream from the switching node apparatus.

- 1 41. The machine-readable medium of claim 32, wherein the resource cancellation
- 2 message is sent to a network node that is upstream from the switching node apparatus.